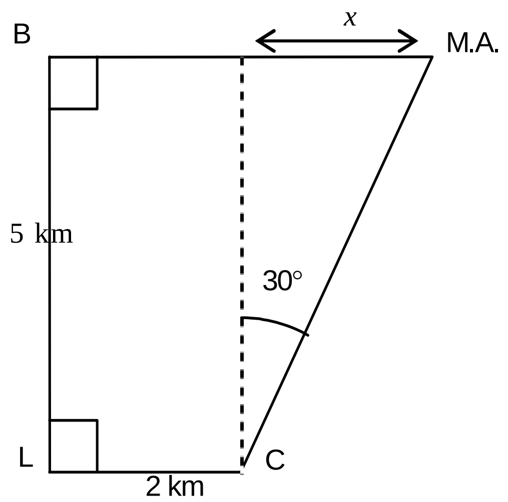
Maths GCSE	# Suggested Answers to Tutor-marked Assignment J

1.



C to MA = $\dfrac{5}{\cos 30} = 5.77$ km to 3 s. f.

$x = 5 \times \tan 30$

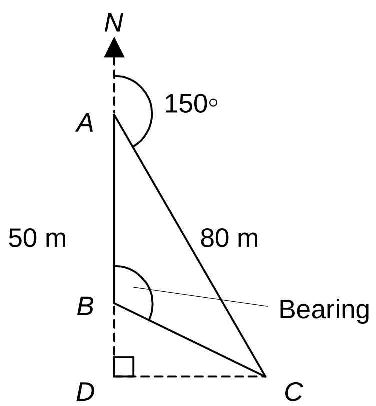
$= 2.886........$

MA to B $= 2.886.... + 2 = 4.89$ km to 3 s. f.

The LEM travelled 5.77 km to reach the Mare Antiqua. The LEM is now 4.89 km from the radio beacon.

(5 marks)

2.



The question asks us to find BC and the angle marked 'bearing'.

I have drawn in the lines BD and DC to produce the large right-angled triangle ADC.

We will use this to find DC and BD so that we can then work with triangle BDC.

$$\frac{DC}{AC} = \sin 30° = 0.5$$

$$DC = AC \times 0.5$$

$$= 40 \text{ m}$$

$$\frac{AD}{AC} = \cos 30° = 0.866$$

$$AD = AC \times 0.866$$

$$= 69.3 \text{ m}$$

But $BD = AD - AB$

$$= 69.3 - 50 = 19.3 \text{ m}$$

Now let us consider the triangle BDC.

By Pythagoras

$$BC^2 = BD^2 + DC^2$$

$$BC = 44.4 \text{ m}$$

We can now find angle DBC

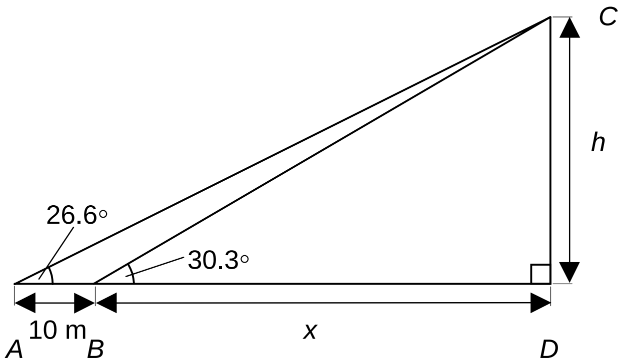
$$\tan DBC = \frac{DC}{DB} = \frac{40}{19.3} = 2.073$$

Angle DBC = 64° to the nearest degree

So the bearing of C from B is 180° – 64°

= 116° (6 marks)

3.



This problem is a little more difficult as we only have one length and two angles. So we let $BD = x$ and $DC = h$.

Now consider the triangle ACD.

$$\frac{h}{(10+x)} = \tan 26.6° = 0.501$$

$h = (10 + x) \times \tan 26.6$

Now consider the triangle CBD.

$$\frac{h}{x} = \tan 30.3°$$

$h = x \times \tan 30.3$

So $x \times \tan 30.3 = (10 + x)\tan 26.6$ (since both parts $= h$)

$$x \tan 30.3 = 10 \tan 26.6 + x \tan 26.6$$
$$x \tan 30.3 - x \tan 26.6 = 10 \tan 26.6$$
$$x\left(\tan 30.3 - \tan 26.6\right) = 10 \tan 26.6$$
$$x = \frac{10 \tan 26.6}{\left(\tan 30.3 - \tan 26.6\right)} = 59.9 \text{ m to 3 s. f.}$$

$x = 60.4$ m

So we can now find h because $h = \tan 30.3 \times x = 35.0$ m

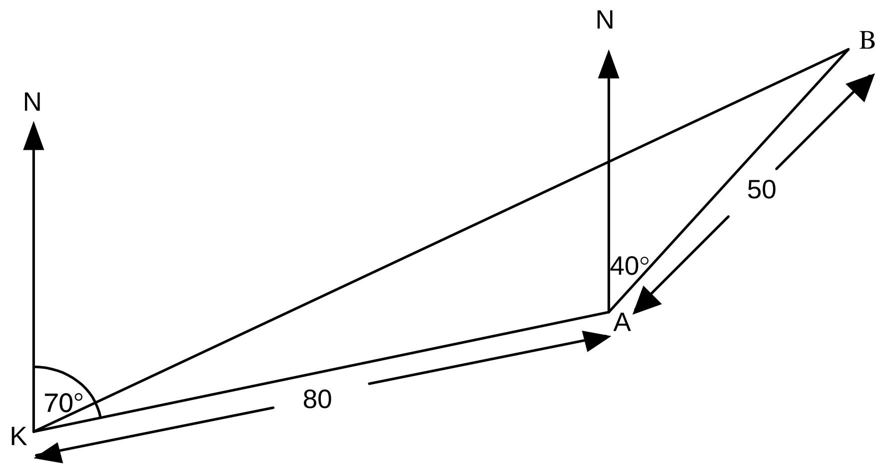
Finally we can find the length of the rope BC by Pythagoras.

(We were not actually told which length to use but logic suggests one would use the shorter distance.)

$BC^2 = x^2 + h^2 = (59.90692331)(10 + x) + (35.00677951)$
$= 4814.314072$

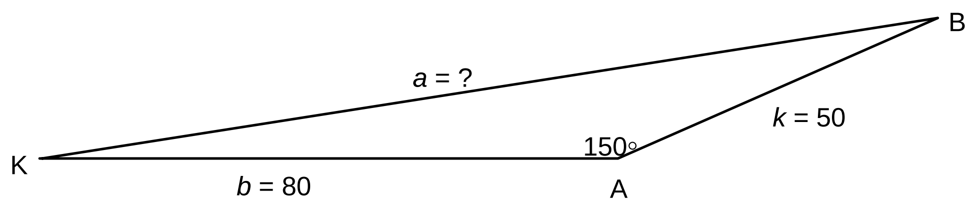
$BC = 69.3852....$ m $= 69.4$ m to 3 s. f. (6 marks)

4.



In order to find the answers we use triangle *BKA* and find angle *BKA* and the length *BK*.

We can use the bearings given to find the total angle at A, which is 150°. If you cannot see where we get this, ask a tutor to explain. So let us now redraw the diagram and see which rule we can apply.



We know two sides and the angle between them so we can use the cosine rule to find the third side.

$$a^2 = b^2 + k^2 - 2bk\cos A$$

But notice that angle *A* is an obtuse angle and the cosine of an obtuse angle is negative.

This makes the equation

$$a^2 = b^2 + k^2 + 2bk\cos(180° - A)$$

$$b^2 = 80^2 = 6400$$

$$k^2 = 50^2 = 2500$$

$2bk\cos(180° - A) = 2 \times 80 \times 50 \times \cos 30°$
$= 6928.20323$

So $a^2 = 15828.20323$

$a = \sqrt{1528.20323} = 125.8101873$

$= 125.8$ km to 1 d. p.

Now we can use the sine rule to find angle K.

$$\frac{\sin K}{k} = \frac{\sin A}{a}$$

$$\sin K = \frac{50 \times \sin 150}{125.8101873}$$

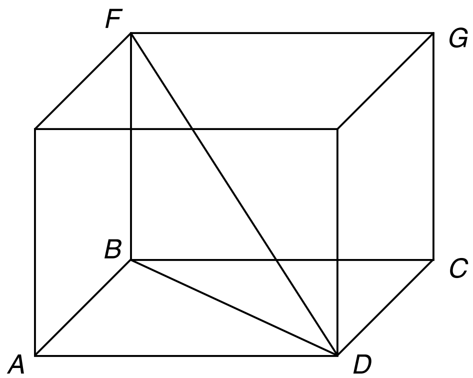
$$= 0.198712048$$

angle $K = 11.46165322°$

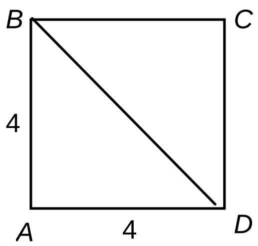
So the bearing is $70 - 11.46165322 = 58.5°$ to 3 s. f.

(9 marks)

5. (a) (i)



In order to find FD we need the triangle FDB, which is right angled at B. We know FB, this is the height of the room. We need to find BD using the square base.



$BD^2 = 4^2 + 4^2$

$= 32$

$BD = 5.656854249$

So $FD^2 = FB^2 + BD^2$
$= 9 + 32$
$= 41$

$FD = 6.40$ m to 3 s. f. (6 marks)

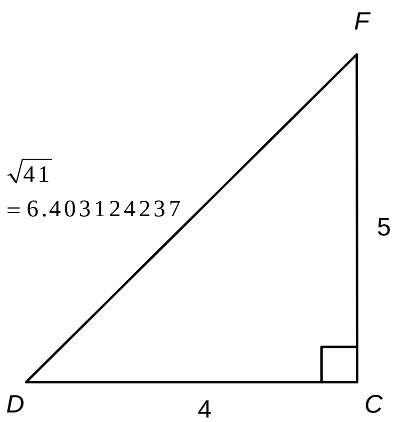
(ii) The angle between FD and the wall $FGCB$. To do this, we need the angle between FD and the diagonal from F across the wall. (You must have two lines in order to measure an angle.)

So we need the length of FC.

$FC^2 = FB^2 + BC^2$

$= 9 + 16$

$FC = 5$ m



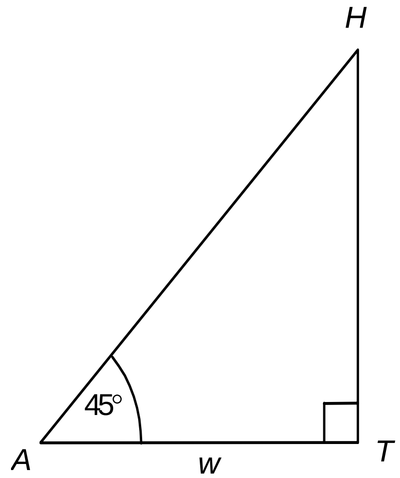
So $\sin F = \dfrac{4}{\sqrt{41}} = 0.624695047$

$F = 38.7^\circ$

(The angle at C must be a right angle because it is between the wall and the base) (6 marks)

(b) They actually tell us which triangles to use

(i) Draw out triangle AHT



$$\frac{HT}{AT} = \tan 45°$$

$HT = w \times 1$

$= w$

(4 marks)

(ii) $\Delta\ HTB$

$$\frac{HT}{BT} = \tan 30°$$

$HT = w$

So $BT = \dfrac{w}{\tan 30°}$

$\tan 30° = \dfrac{1}{\sqrt{3}}$

$BT = \sqrt{3}\, w$ (4 marks)

(iii) By Pythagoras

$BT^2 = AT^2 + AB^2$
$3w^2 = w^2 + 400$
$w^2 = 200$
w $= 14.1$ m

(4 marks)

6.

(a) BAD = 90° Angles in a semi-circle.

(b) DBA = 180 – 90 – 30 = 60° Sum of the angles in a triangle = 180°.

(c) CBA = 30 +45 = 75° Opposite angle in a cyclic quadrilateral = 180° (or equivalent meaning)

180 – 75° = 105° (6 marks)

7. (a) b

(b) $\frac{1}{2}a$ or $\frac{a}{2}$

(c) $\overrightarrow{EF} = \overrightarrow{BA} = -\overrightarrow{AB} = -\frac{a}{2}$

(d) $\overrightarrow{FD} = \overrightarrow{FA} + \overrightarrow{AC} + \overrightarrow{CD}$

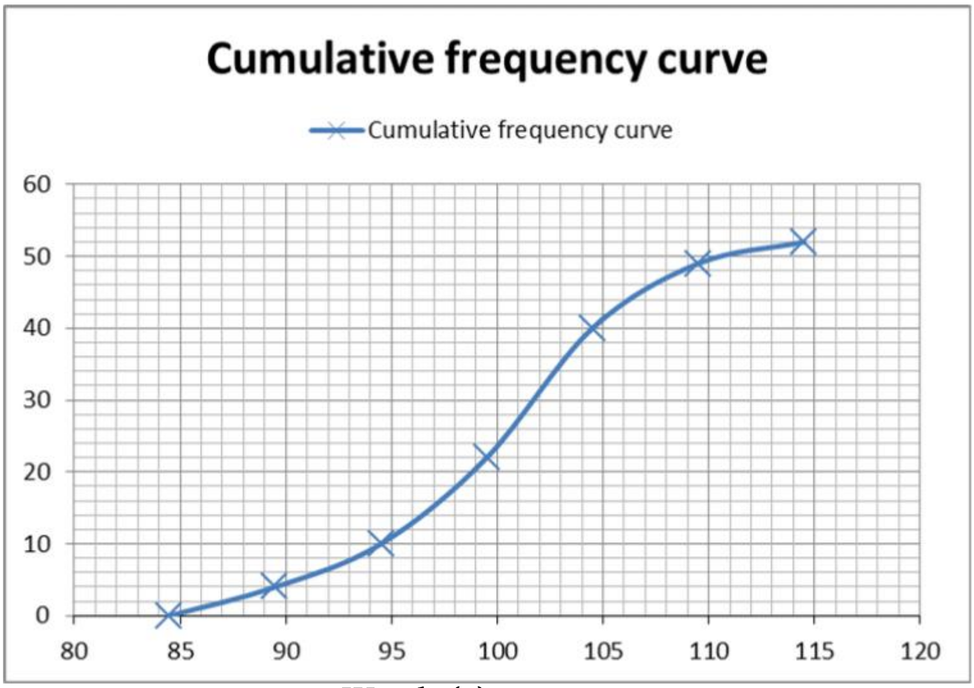
$= -b + a + c$ (5 marks)

8.

(a) The weights are given to the nearest gram so the true intervals are:

Weight (g)	84.5 – 89.5	89.5-94.5	94.5-99.5	99.5-104.5	104.5-109.5	109.5 – 114.5
Frequency	4	6	12	18	9	3
Cumulative Frequency	4	10	22	40	49	52

(3 marks)



Weight(g)

(b)	See above.	(4 marks)
(c)	101	(2 marks)
(d)	96, 104	(4 marks)
(e)	8	(1 mark)
(f)	33%	(2 marks)
(g)	17%	(2 marks)
(h)	29	(1 mark)

(19 marks)

Total for TMA: 80 Marks